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never seen in the seas, nor caught at such depths, as we have had occasion to fathom or search: hence can never be classed among the sailors; nor indeed does it seem at all proper for exercising that function, from its long narrow pointed shape, so very different from that boat-like figure requisite for sailing. Its concamerations seem principally intended for performing the motions necessary to the animal, at the bottom of the sea, and at greater depths, from whence it does not seem ever to rise to any considerable height.

Brussels, May 18,
1756.

Edw. Wright.

CV. *An Account of the Orthoceratites :
In a Letter from Edward Wright, M. D.
to Mr. Peter Collinson, F. R. S.*

S I R,

Read June 17, 1756. **I** HAD the honour of sending you some time ago a drawing and short account of a very large Orthoceratites, which I hope you have received. As you are so good to accept favourably my poor observations, and to honour me with your correspondence, I here take the liberty to send you a few remarks, which the consideration of this and other fossils, and of the strata of the surface of the earth, naturally lead me to. If I am obliged to differ from Mons. de Buffon, and other modern theorists, it is only for the sake of truth, and its unalterable laws; it being quite contrary to my inclination.

tion to criticize the works of others, especially those of so learned a gentleman, as the above-mentioned academician, for whose merit and talents I have a particular respect, except where the clearest conviction, in opposition to his opinions, forces me to so disagreeable a task.

I. The *Orthoceratites* is one of those shells, which are never found in the recent state, and is to be classed among *Conchæ pelagiæ* of the naturalists, which never approach the shore, but continue always at great depths of the sea, contrary to the *littorales*, which frequent the shores and shallow places; and hence, when found fossil, are easily to be matched with recent specimens.

Pelagian or ocean shells are frequently found fossil very near the surface, as every naturalist knows, which proves, that such places have formerly been the sea-shore. Hence it is clear, that the cause, which transported them thither, acted suddenly; which agrees perfectly with the account of the deluge given by Moses in the holy scripture; and, at the same time, overturns the system of Mons. de Buffon, and the author of *Tellamed*, who pretend, that the earth was for many ages covered with water, and that in that long course of time it was, that the shells, which we now find fossil, were gradually produced; hence that they are to be considered as the remains of innumerable successive generations of marine bodies, formerly the only inhabitants of the globe. The greatest depths of the sea, as yet sounded, have been found to be about 3000 fathoms, and the ordinary depths are about 150; which makes it evident, that were the theories of these gentlemen true, such fossil shells

shells ought never to be found at less depths in the earth than from 150 to 3000 fathoms.

II. Though fossil shells are to be found in almost all the plainer parts of the surface of the earth, yet there are certain very large tracts, where such bodies are never found, *viz.* the mountains, which seem to be the remains of the original strata of the earth. It is true indeed, that there are many eminences, which have been by our modern theorists taken for mountains, where sea-shells, and calcareous matter, of every kind, are to be found in great abundance: but these are very inconsiderable, and only appear as little hillocks, compared with the large mountains, which contain mines, veins of metal, and precious stones, and may be traced in immense chains, without almost any discontinuity from one continent to another; and from continents to neighbouring and opposite islands, &c. insomuch that all these chains not only of the old, but likewise of the new world seem connected one with another; an observation which alone would indicate the importance of diligently inquiring into their structure, in order to form a true theory of the earth. Mons. de Buffon and the author of *Telliamed*, who endeavour to prove, that all mountains have been formed by sea-currents, and bring one of their principal arguments in proof of this opinion from marine bodies being found in great quantities in the strata, of which they are composed, seem never to have made observations on mountains; else they might have observed this remarkable difference between them and the calcareous strata of the plains, that the former contain none of those marine bodies, though the latter are almost intirely made up of them.

In

In the Alps, Appennines, and Pyreneans, no shells nor marine bodies of any kind are to be found : in the *Ochels*, a branch of the large Grampian Mountains in Scotland, which I have had occasion diligently to examine, I could discover no marine bodies. The same is observed of all the large mountains of Africa, and of Asia ; and in the huge chain of Cordilleres in Perou Mons. de la Condamine searched in vain for such bodies. This kind of mountains, (which indeed alone deserve that name) are chiefly composed of vitrifiable matter ; and if they are sometimes found to contain sea-shells, it is never to great depths, nor in their original metallic or stony strata ; though such bodies are found in great abundance at the foot of mountains, and in the adjacent valleys, in which there are many eminences in some parts continued in small chains, though but of small extent, which contain marble, sea-shells, chalk, and other calcinable matter, but never any veins of metal, though we frequently find in them pyrites, ocre, vitriols, and other minerals, which have been washed down from veins of iron and other metals, with which the higher mountains abound, and have afterwards been deposited in the calcareous strata of the valleys.

III. Mons. de Buffon pretends, that all mountains have been formed by sea-currents ; and a little afterwards tells us, that all sea-currents are occasioned by sea-mountains. Is it not natural here to ask, Which of these two causes pre-existed ? Can such reasoning as this, a *circulus viciosus* of the grossest kind, ever tend to improve our knowledge, or give us just views of the works of the great Creator ?

The

The learned academician founds his opinion of all mountains having been formed by sea-currents, principally upon two observations. The first is, that they are made up of strata composed of sea-shells, and petrified marine bodies of different kinds : the second, that in chains of mountains the prominent angles always correspond with the depressed ones on the opposite side of the valley, in the same serpentine way as we observe in rivers, the banks of which are alternately hollowed and prominent, according to the different resistance they give to the current of the water. This observation was first made by Mons. Bourguet, and must be owned to be curious and interesting. Mons. de Buffon is of opinion, that these two essential observations put together form an invincible argument in proof of his theory, and such as could scarce have been expected in so seemingly obscure a point. As to the first observation, that all mountains are made up of strata composed of marine bodies, it is so far from being true, that *no mountains, properly so called*, contain such bodies : and as to the second, of the correspondence of the opposite angles of mountainous tracts, it does not at all prove, as he would have it, that sea-currents have formed these mountains, but only that there have been formerly such currents running between them, which currents have given them that form we now observe them to have. To assert, that because currents of water have given them that figure, therefore they have produced them, is as ridiculous, as if one should say, that a river had reared its own banks, merely because it had given them a serpentine form.

IV. *Monf. de Buffon*, who pretends, that the earth was at first entirely covered with water, which afterwards dug channels for itself, and thus separated the sea from the land ; and the author of *Tellamed*, who endeavours to prove, that this water goes insensibly off by evaporation ; and who, as well as *Monf. de Buffon*, attributes the number of sea-shells, found fossil, to the length of time he supposes the now inhabited parts of the earth to have been covered with water, seem not to have given sufficient attention to an observation of consequence, which is, that the greatest part of our fossil shells are entirely foreign to Europe, and belong to the Equator or Tropicks. *Monf. de Buffon* himself seems to have been somewhat aware, how much this observation might make against his theory ; for he observes in answer to it, that not to mention such shell-fish, as inhabit the bottom of the sea, and from hence, being difficult to be caught, are regarded as unknown and foreign, though they may be produced in our seas ; by comparing our fossil shells with their analogous living shell-fish, we shall find amongst them more shells belonging to our own coasts than of foreign ones ; for example, that pectens, pectuncles, mussels, oysters, sea-glands, buccina, sea-ears, patellæ, &c. which we find fossil almost every-where, are certainly productions of our own seas. But unluckily for our ingenious theorist, these shells, he mentions as common on our coasts, are produced in all the seas of the globe, and are equally inhabitants of the equator and poles ; though we frequently discover fossil species of them, which are peculiar to the warmer climates.

Since then it is certain, that all our fossil shells are foreign to our climates, except such, as are common to the whole globe, we may conclude, that *Monf. de Buffon's* theory is in this respect absolutely defective. Besides, we find not only a very great quantity of fossil shells and other marine bodies, but likewise a great number of impressions of foreign plants, mostly of the capillary kind, on slates and other stones; and it is now certain, that all the fossil wood of *Lough-neagh* in Ireland (as in most other places, where such wood is found) has been produced in a different climate; and, if I mistake not, has been compared and found to agree with recent specimens from America. Bones, and even intire skeletons of rhinoceroses, elephants, and other foreign land animals, are discovered pretty commonly through all Europe; and in Ireland, very large horns of American moose-deer have been dug up. All these substances are commonly found near to, or in the same strata with, fossil shells, and other marine bodies; and all of them, whether original productions of sea or land, appear evidently to have been deposited in the places, where we now find them, by one and the same cause. To account for these phenomena, I believe *Monf. de Buffon* must admit a universal deluge, such as is related in the Holy Scripture: and if a deluge of this kind is once admitted, why should we assign other causes for the transportation of marine and terrestrial bodies into climates foreign to those, where they were produced? Why, say *Monf. de Buffon* and the author of *Telliamed*, because many thousands of years seem to have been requisite for the production of so immense a quantity of sea-shells as those we find

find every-where fossil ; and besides, says the author of Telliamed, their disposition is so regular, that it is plain the confusion of a deluge could never have placed them in such a manner. But as to the immense quantity of fossil shells, upon which these gentlemen insist so much, they have been misled by imagining, that many parts of the surface of the earth contain marine bodies, which evidently do not ; and these parts are, as I observed above, the mountains properly so called, in the constituent strata of which no sea-shells nor marine bodies of any kind, no bones of land animals nor impressions of plants, are to be found. And as to the regular disposition of these bodies, this could not have happened in supposing a violent commotion of the waters to have continued the whole time they covered the earth. But is such a supposition natural or necessary ? From the scripture account, I am sure, it is not ; for the *rupti sunt fontes abyssi* implies, that this was only to procure water sufficient for the deluge ; and that the waters afterwards receded gradually, and were restored to tranquillity before they entirely disappeared, is manifest from the same inspired writings. Upon the whole, we may dare boldly to advance, that we meet with daily observations, that destroy all the fine hypotheses of our modern theorists, but not a single one in the least contradictory to the simple, and at the same time sublime and true account delivered by the sacred historian. How vain are the efforts of man, when he has the boldness to set up the chimæras of his own brain in opposition to so much of the truth, as Almighty God has permitted us to discover from his holy word, and from the observation of his works,

which he has given us talents to contemplate and admire!

V. The deluge must have produced very considerable changes on the surface of the earth. Many Volcanos seem to have been formed at that time by the accumulation of animal vegetable and mineral substances into huge masses, which have afterwards fermented and putrified, and in process of time burst out into flames. Earthquakes must have been frequent the first years after the deluge by the fermentation of these heterogeneous bodies, before the remains of so prodigious an inundation could be dissipated; for wherever there is any intestine commotion in the earths, it's violence must be greatly increased, if it meets with water, and by its heat reduces it into vapour, which we know acts with an immense force *. That this must have been the case the first years after the deluge, may be inferred from the abundance of moisture it must have left, and the fermentation of so great a quantity of heterogeneous substances buried in ruins by that memorable catastrophe. There are many observations, which seem to prove, that the earth, or at least many parts of its surface, have suffered by fire; not to mention the marks of it, which are to be observed on many mineral substances. The artificial production of potter's earth or clay is a very strong argument in support of this opinion. Potter's earth, as is well known, is

* This seems to be the reason, why places situated upon the sea-shore, or upon large rivers, as was the unhappy city of Lisbon, suffer more from earthquakes than more inland situations, where such circumstances do not concur.

found plentifully in most low grounds and vallies between mountainous tracts, and where calcareous strata abound. By exposing common flint-stones to the confined vapour of boiling water in Papin's digester, a clay of the very same kind may be formed, and is no more than a decomposition of the flints. Hence it would appear, that wherever this clay is to be found, there the earth has undergone some violence from fire; and that this has been effected by earthquakes soon after the deluge seems extremely probable.

The deluge has given origin to many fossil substances, and produced many combinations, which otherwise would not have happened. Chalk is no more than the ruins of sea-shells, and limestone consists of the same bodies cemented together by a stony juice. Amber appears evidently to be the resin of antediluvian trees (which are frequently found along with it at this day) united to the acid of sea-salt, which abounds in the earth. The reason of insects, straws, &c. being immersed in amber, absolutely inexplicable from the hypothesis of its being of mineral origin, is now no more a secret; for we know, that nothing is more common than to find such bodies immersed in the resin of trees. Fossil sea-salt or salt-gem seems to have been deposited in the quarries, from whence it is dug, at the time of the deluge. All or most part of pit-coal appears to be of diluvian origin, for it gives a *caput mortuum*, the texture of which exactly resembles that of burnt wood. We may reasonably suppose large forests to have been buried at the time of the deluge, which have undergone a fermentation and putrefaction in the earth, so that the colour of the woody part has
been

been changed, though the texture has remained entire enough to allow us to distinguish to what kingdom it belongs.—All bitumens, pissasphaltum, pefilæum, &c. seem to be no more than productions of resinous substances united with mineral acids, which have caught fire in the earth by fermenting with heterogeneous matter, and have thus undergone a sort of natural distillation and exaltation. These are more than chimerical notions, and are even demonstrated by experiments; for amber can be produced artificially, as likewise bitumens by the distillation of resinous substances with mineral acids; and there is great probability, that pit-coal might be imitated. I am,

S I R,

Brussels, June 11,
1756.

Your most obedient and

obliged humble servant,

Edward Wright.

CVI. *A Retraction, by Mr. Benjamin Wilson, F. R. S. of his former Opinion, concerning the Explication of the Leyden Experiment.*

To the ROYAL SOCIETY.

Gentlemen,

Read June 24,
1756.

I Think it necessary to retract an opinion concerning the explication of the Leyden experiment, which I troubled this Society with